smaller swellings, which caused little pain and discharged purulent fluid; no further antibiotic treatment was given and all cultures were sterile. In December 1979 she ran out of surgical spirit and had to sterilise her syringe with boiling water. While reading the syringe instructions she noted that the manufacturers specifically advised the use of industrial methylated spirit for storage. She therefore changed her storage method and has had no further trouble at her current insulin injection sites on the abdomen. The swellings in her thighs, however, have continued to develop and discharge and she has many scars that are cosmetically disfiguring.

Comment

It may not be widely known that surgical spirit contains additives such as castor oil, methyl salicylate, and diethylphthalate as well as industrial methylated spirit. Constant use results in a build-up of oily residues on the inner surface of the syringe, and on occasions free passage of the barrel may become obstructed. On the other hand, industrial methylated spirit consists wholly of volatile alcohols and leaves no residue, the British Pharmacopoeia specification being no more than 0·1% v/v compared with approximately 5% v/v for surgical spirit. There is little doubt that these oily residues would be sufficiently miscible with certain types of insulin to be deposited with the latter at the injection site. This patient had also noted that the use of anti-inflammatory creams, which contain methyl salicylate, caused an extensive erythema and irritation of her skin.

It appears that surgical spirit, despite its clinical connotation, may be a dangerous storage fluid and it is undoubtedly less free of additives than industrial methylated spirit, even though the term "industrial" implies a greater degree of impurity. Doctors working in diabetic outpatient departments or general practice may therefore be tempted to insist on surgical spirit being used. The incidence of necrosis at injection sites is not known and it must be rare without an associated hypersensitivity to the additives in surgical spirit. Nevertheless, it is wise and imperative that the manufacturers' instructions, which emphasise the use of industrial methylated spirit and give details of the method of dispersing the volatile alcohols, are carefully followed.

Recent examination of this patient, who has been using industrial methylated spirit for three months, shows no sign of swellings in the current injection sites. Although we have not carried out tests for hypersensitivity the surgical spirit probably caused the complications.

(*Accepted 9 May 1980*)

Department of Microbiology, Wycombe General Hospital, High Wycombe, Bucks HP11 2TT
D A LEIGH, MB, BS, consultant microbiologist

Hinders Leslies Limited, London E17 6EJ
G W HOUGH, BSC, technical manager

A better system for polio vaccination in developing countries?

Poliomyelitis is an important health problem in developing countries, and unfortunately there are serious difficulties in preventing it by the use of oral polio vaccine. The vaccine is manufactured in only a few developing countries; elsewhere it has to be transported long distances and yet must be kept constantly cold to maintain its potency. Even when fully potent vaccine is given three doses are insufficient for effective immunisation in countries like India because of low seroconversion rates.[1 2] Several methods have been suggested to improve the efficacy of oral polio vaccine: increasing the potency; giving monovalent rather than trivalent vaccine; and giving five rather than three doses.[1-3] But all these methods add to the problems of immunisation, and we have therefore designed and tested a strategy of giving the vaccine that is simpler and yet improves its efficacy.

Subjects, methods, and results

All children aged from 3 months to 5 years in one village 10 km from Vellore were given their first dose of oral polio vaccine during one morning in August 1978. Second and third doses were given at monthly intervals, again during one morning, in September and October. We collected blood from the children immediately before the first dose and four weeks after the third dose and tested all the sera for the presence and titres of neutralising antibody, at a starting dilution of 1/8, against 100 $TCID_{50}$ of poliovirus types 1, 2, and 3.

Two batches of imported oral polio vaccine were purchased from the supplier and brought to the laboratory in insulated containers containing ice. They were stored at −20°C and tested for potency just before use by titration in primary bonnet-monkey kidney cells. The vaccine was taken to the village in insulated cold boxes. Its potency was poor—in the first batch 10^4 $TCID_{50}$ per dose and in the second $10^{4\cdot5}$ $TCID_{50}$ (the recommended potency is $10^{6\cdot1}$ $TCID_{50}$). The first batch was given for the first dose and the second for subsequent doses.

Eighty children were vaccinated, but paired sera were available from only 51. Among them 34, 26, and 21 were without antibody before vaccination to types 1, 2, and 3 poliovirus respectively, and 25, 25, and 15 responded with antibody production (table).

Seroresponse after cluster vaccination with substandard oral polio vaccine (OPV) compared with seroresponse after sporadic vaccination with potent OPV.

Vaccine and strategy	Seroconversion rate (%)			Reference No
	Type 1	Type 2	Type 3	
Poor vaccine and cluster strategy	74	96	71	Present study
Potent vaccine and sporadic strategy	69	90	76	1

Comment

In a previous study when we gave three doses of fully potent oral polio vaccine to children in an immunisation clinic we obtained seroconversion rates of 69%, 90%, and 76% to the three serotypes (table). The immunisations were spread over several weeks and the children were not from any one community. The seroconversion rates obtained in the present study were equally good even though the vaccine had a potency only 0·7-2·1% of that recommended. We assume that the rates would have been considerably better if we had used fully potent vaccine.

The comparatively good seroconversion rates were unlikely to be due to wild poliovirus infection in the community since response was seen against all three serotypes in a short time, whereas natural infection occurs with one type at a time.[4] We believe that the most probable reason was that the vaccine viruses became the enteric viral flora among the children for a time and thus enhanced the overall infection rates. The spread of vaccine virus infection has been recognised by several investigators. The phenomenon was shown strikingly in a study in orphanages in Bandung—where 40 young inmates were given two doses of oral polio vaccine six weeks apart and 99 older inmates were given placebo, and yet seroconversion rates were roughly equal in both groups.[5] This effect is likely to be greatest when large groups are vaccinated in a short time ("cluster" or "pulse" immunisation) and minimal with sporadic vaccination.

We think that if these results are confirmed when fully potent oral polio vaccine is used this cluster technique may be a considerable improvement on existing strategies of immunisation.

This study was supported in part by the Indian Council of Medical Research.

1 John TJ. Antibody response of infants in tropics to five doses of oral polio vaccine. *Br Med J* 1976;i:812.
2 Domok I, Balayan MS, Fayinka OA, Skrtic N, Soneji AD, Harland PSEG. Factors affecting the efficacy of live poliovirus vaccine in warm climates. *Bull WHO* 1974;**51**:333-47.
3 John TJ, Devarajan LV, Balasubramaniam A. Immunisation in India with trivalent and monovalent oral poliovirus vaccines of enhanced potency. *Bull WHO* 1976;**54**:115-7.
4 John TJ, Kamath KR, Feldman RA, Christopher S. Infection and disease in a group of south Indian families. 9. Poliovirus infection among preschool children. *Indian J Med Res* 1970;**58**:551-5.
5 Suwaryo SI, Permadhi H, Alisjahbana A, Thaila S. Trial of oral poliovaccination on children of several orphanages and nurse families in Bandung. *Paediatrica Indonesiana* 1976;**16**:255-68.

(*Accepted 9 May 1980*)

Christian Medical College and Hospital, Vellore 632004, Tamil Nadu, India
T JACOB JOHN, FRCPE, PHD, professor and head of department of virology
ABRAHAM JOSEPH, MD, DCH, reader in department of community health
P VIJAYARATHNAM, senior technician in department of virology